SCIENCE.

FRIDAY, OCTOBER 29, 1886.

COMMENT AND CRITICISM.

A GOSSIPY WRITER in the *Nineteenth century* magazine has given us an interesting article on what girls read. He refers, of course, to English girls, but most of his data and all of his conclusions suit our young women quite as well as their British cousins. He shows that authors for girls have been developed, and form quite as distinct a class as Reid, Verne, Hughes, and others who write primarily for boys. Among this class he enumerates Mesdames Alcott, Dodge, Marshall, Banks, Browne, Beale, Symington, Owen, Sewell, Wetherell, Holmes, Meade, and Yonge. To Miss Alcott the writer himself awards first place, and speaks very highly of her books. He finds that an unnatural tone pervades much, if not all, of the current literature for girls, and says its teaching may be summed up thus: "If you are wicked, you must reform; and when you have reformed, you will die." Good biographies, he continues, form the best reading for girls, for "fiction should lend relief to girl-life, biography should impart high-principle and poetry grace." Some interesting statistics are appended to the article, being made up from answers by one thousand girls between the ages of eleven and nineteen.

The answers to the two questions, 'Who is your favorite author?' and 'Who is your favorite writer of fiction?' are added, together with the following result, those names receiving fewer than five votes being omitted: Dickens receives 330 votes; Scott, 226; Charles Kingsley, 91; Charlotte M. Yonge, 91; Shakspeare, 73; E. Wetherell, 54; George Eliot, 41; Lord Lytton, 41; Longfellow, 31; A. L. O. E., 30; Canon Farrar, 22; Thackeray, 18; Verne, 16; Macaulay, 13; Miss Alcott, 12; Mrs. Stowe, 11; Tennyson, 9; Carlyle, 6; Ruskin, 6; Charlotte Brontë, 5. The above, being the vote received by the principal authors, is curious in several respects. First, it is odd that authors whose works are classic should so far outstrip those who appeal especially to a girl audience. This may be explained either by saying that the girls put down names of authors whose works they knew they should read rather than those whose works they actually do read; or it may be that the parents and teachers generally recommend such authors as Dickens and Scott, and that their advice is more generally followed than is usually believed. Again, it is curious to see Longfellow so far ahead of Tennyson, Carlyle, and Macaulay, in a list made up by English girls.

THE QUESTION HAS OFTEN been asked, For what purpose were mosquitoes created? Dr. Finlay of Havana seems to have answered the question, in part at least, by announcing that the mosquito is one of the active agents in the spread of yellow-fever. The doctor's theory is, that the sting of the insect, after penetrating the skin of a yellow-fever patient, retains on its exterior the germs of the disease, which may thus be conveyed to the next person it attacks. As a result of his study, he finds that every mosquito that stings may be considered a fecundated female, and will probably deposit its eggs within a few days after its bite, provided it can find water in which to deposit them. The young mosquito will be developed in about three weeks. As the eggs are deposited in the locality where the female stung its victim, the young would also be produced there, and, finding the yellow-fever patient near by, would sting him, become infected, and carry the germs to other human beings. Dr. Finlay believes that yellow-fever is not transmitted through the air nor by contact, but by inoculation, largely by means of the mosquito. He regards the disease as incapable of propagation wherever tropical mosquitoes do not or are not likely to exist; ceasing to be epidemic at the same limits of temperature and altitude which are incompatible with the functional activity of the insect, and spreading wherever the mosquito abounds. Dr. Finlay reports, as confirming his views, that in the summer of 1885 mosquitoes were scarce in Havana, but were very numerous in the autumn, and that, although the summer was unusually hot, yellow-fever cases were few in number, but in October and November increased considerably. The subject which has been thus brought to the attention of medical men and sanitarians is one which, it would seem, admits of

proof or disproof ; and the experience of others practising in regions where yellow-fever prevails will doubtless elucidate the question.

IF, AS MANY THINKERS CLAIM, the chief philosophic interest in England now centres about psychology, the current issue of *Mind* cannot be cited as evidence to the contrary. It is distinctly psychological. Professor Bain writes approvingly of Mr. James Ward's Encyclopaedia Britannica article on 'Psychology,' though, of course, mentioning his points of difference from the Cambridge professor. Professor Bain's argument, that a series of states can be aware of itself, seems to us very weak and inconclusive. The president of the Aristotelian society, Mr. Shadworth H. Hodgson, takes up the articles by John Dewey of Michigan university, which appeared lately in *Mind*, and attacks them vigorously as based on 'unwarrantable assumptions.' Mr. Hodgson has no difficulty in making out a case. The following article on Hegel's conception of nature, by S. Alexander, is far more clear and interesting than expositions of Hegel usually are. Dr. Cattell continues the record of his psycho-physical experiments, treating now of will-time and of the influence of attention, fatigue, and practice on the duration of cerebral operations. Joseph Jastrow records his investigations into the perception of space by disparate senses. The book reviews are as full and valuable as usual.

THE DEGREE TO WHICH the medical charities are abused in this country is beyond computation. Hospitals and dispensaries which were organized for the relief of the poor are daily thronged with the well-to-do ; and even the rich do not scorn to take advantage of the services of the physicians which can there be obtained gratuitously. It was recently estimated that about one-fourth of the inhabitants of Boston were receiving medical treatment free ; in London and New York the proportion is about the same ; in Philadelphia it is one-fifth ; and in Liverpool, 298,320 persons in a population of 579,724, or more than one-half, are, according to the *British medical journal*, receiving free treatment in their illness. The writer knew of a case in one of our large cities where a lady came to a dispensary for treatment in her carriage, leaving it a block away, and walking that additional distance. Physicians on duty at these places not infrequently learn that their patients have been spending a portion of the summer at Long Branch or in the Catskills. Dr. F. F. Doggett of Boston read a very interesting paper on this subject before the Massachusetts medical society, calling attention to the abuse of the present methods, and suggesting a plan for their improvement based upon practical experiments of his own in this direction, which have been carried out with success since 1883. Briefly, his plan consists in ascertaining the financial condition of the applicant, and, if he finds him able to pay for treatment, to refuse to prescribe for him at the dispensary. Dr. Doggett has found that this plan has reduced to a minimum applications from those whose means will permit them to employ a physician at their own homes, while at the same time it has not prevented the relief of the poor, and indeed has been greatly to their advantage by permitting the physicians in attendance at the dispensaries to give them more time and attention. Dr. Hall, of the northern dispensary of New York, has followed a somewhat similar plan, with like results. Dr. Derby of Boston, in speaking of the methods to correct these abuses, says, "The solution of the whole matter seems to me so simple that I mention it with diffidence. It is but to accept the principle that the out-patient department is for the benefit of those whose lack of means would prevent their obtaining relief elsewhere, and to leave the application of this principle to the physician in attendance. When any thing in the dress, manner, or statement of the individual causes hesitancy to be felt, a few questions, put with tact and kindness, will readily resolve the matter ; or, if any doubt should still be felt, the applicant for aid should certainly receive its benefit." The evils of this gratuitous treatment to those who are able to pay are many, not the least of which is the effect upon those who receive it, lessening their self-respect, and causing them to look about for gratuitous assistance in other directions. If a central bureau could be established to investigate the claims of all applicants for free dispensary treatment, much good would be accomplished. Unless this was done, or some plan generally adopted, the rejected ones would apply at other dispensaries and be treated there.

THE *Meteorologische zeitschrift* (Berlin) for June contains a note by Lieutenant Sobieczky of the Austrian navy on the meteorological stations in the West Indies, which he had opportunity of visiting. Mention is made of the former establishment of stations during the hurricane months of

the autumn in connection with our signal service, now mostly abandoned by reason of an unfortunate and unwise economy. The more important existing stations, fitted with good instruments and in the care of good observers, are as follows: Havana, Cuba, at the Jesuit college, in charge of Padre Benito Viñez; Kingston, Jamaica, in charge of Prof. Maxwell Hall; Port au Prince, Hayti, directed by Jesuit priests; two in San Juan, Porto Rico, one controlled by the government, the other in a Jesuit monastery. Besides these, there are records of less detail kept at Santiago, Cuba, and on the several English islands; but they are not published in good or easily accessible form, if published at all. Considering the direct importance of uniform series of observations on the Antilles, especially during the hurricane season, and the probability that observers could be found there if instruments could be supplied to them, the field commends itself to international cultivation; and in time we trust to see our hydrographic and signal offices taking the lead together in this work, to which other nations will undoubtedly contribute a valuable assistance.

THE LEGISLATORS of European countries seem to be ever on the alert to devise means by which the general health and vigor of the youth may be increased. While it may be true that the real motive which actuates these efforts is not a philanthropic one, but is rather with the idea of raising up material for an army with which to defend the fatherland or to carry conquest into other countries, still the end which is reached is a most beneficial one. By a law recently enacted in Germany and Switzerland, the principals of all schools are required to dismiss their pupils at noon of every day on which the thermometer registers, at 10 A.M., 20° Reaumur (77° F.). We commend this action as worthy of reproduction in this country to those who, during the coming year, will serve in our state legislatures.

THE PRELIMINARY ACCOUNT of an analysis of the Mexican codices which appears in this number of *Science* aroused an unusual interest in the section of anthropology at the recent meeting of the American association. All previous attempts at deciphering these queerly artificial systems of picture-writings were confessedly inadequate; and the principle of ascribing a phonetic value to the characters, and not a merely symbolic one, is as rich in its consequences as it was unexpected. It is highly improbable that a method of interpretation yielding such definite and rational results even in a small number of instances should not be the key to a large portion of the writings; just as improbable, for example, as that a thousand letters of a printer's 'pie' should happen to form rational sentences. Moreover, the discovery of the determinative signs does much to complete whatever gap may have been left in the evidence. Linguists and anthropologists alike will await with anxiety the results of the application of this promising innovation to the mysterious remains of Mexican thought and customs.

TECHNICAL EDUCATION.

IT is pleasant to notice that the subject of technical education and manual instruction in connection with the public-school system is being actively and favorably discussed in New York City. The board of education some time ago appointed Messrs. Dewitt J. Seligman, Henry L. Sprague, and E. J. H. Tamsen a special committee to make a report on the subject of technical education, and on Oct. 13 their report was received and discussed by the board. The report emphatically favors the introduction of manual training into the public-school system, and points out that it may be accomplished in one of two ways: first, separate schools for manual training may be established; or, secondly, it may be made part of the regular course of study, as now pursued in the various schools. Inasmuch as the superintendent of school buildings reported that there were vacant rooms in various schools, the committee was of opinion that mechanical or constructive drawing, modelling in clay, wood-working by means of hand-tools, etc., could be taught immediately, such vacant rooms being used for the purpose. To carry out the proposed experiment in male grammar schools, the committee asked the board of education to apply to the board of estimate and apportionment for an appropriation of fifty thousand dollars.

The manual training of girls was not overlooked by the committee, and an additional ten thousand dollars was asked for in order to introduce experimentally into the female grammar schools instruction in elementary cooking (twelve lessons, of two hours each, would suffice, in the committee's opinion), instruction in sewing (sewing is now compulsory one hour a week in the primary schools for girls), and to provide for courses of lectures to the older girls on the elementary rules of housekeeping. Some discussion arose concern-

ing the adoption of the report, some of the older members of the board of education seemingly regarding the proposed innovation as a reflection on the character of the education now given, and therefore opposing it.

Unfortunately the special committee was defeated in its request for immediate action; and, as the report was referred to the standing committee on the course of study, it is hardly possible that, even if it is finally adopted, any thing can be accomplished under it for another year. But the report itself, the favorable reception it has met with in the press and among all intelligent citizens, and much of the discussion concerning it in the board of education itself, clearly indicate that this proposed advance in the common-school system of the metropolis will soon become an accomplished fact. It is only a question of time now, and we trust of a short time.

ANNUAL MEETING OF THE NEW ENGLAND METEOROLOGICAL SOCIETY.

THE third annual meeting of the New England meteorological society was held at the Institute of technology, Boston, Oct. 19. Prof. J. D. Whitney read a paper on 'Rainfall statistics in the United States,' considering especially the statements that have been made concerning the increase of rainfall on the western plains as a result of cultivation of the ground. These statements are considered altogether untrustworthy. In dry regions the amount of precipitation is generally variable. The records kept in the west are seldom of long enough period, of sufficient accuracy, or of sufficient uniformity, to decide so large a question. Moreover, in the eastern part of the country, where long records have been kept, no definite variation in the precipitation is found.

Mr. S. A. Eliot read an essay on the 'Relations of forests to rainfall and water-supply.' The common opinion that forests increase and clearings decrease the rainfall was traced to the authority of eminent writers, based, not on well-kept observations of rainfall under these contrasted conditions, but chiefly on the well-known diminution of stream-flow in cleared districts. This, however, may be due to increased evaporation rather than to decreased rainfall. Forests undoubtedly retard evaporation of fallen water, but it is very problematic if they increase the amount that falls. Mr. Fitzgerald commented on this by referring to a statement, apparently on the authority of DeLesseps, that the rainfall along the Suez canal had increased since trees were planted there. On writing directly to DeLesseps, answer was received that he had made no such statement, and that there were no facts to support it. Mr. Davis added, that, if the causes controlling rainfall be separated into those dependent on and independent of forests, we find that the latter are now powerless to produce forests in forestless countries, such as those around the eastern Mediterranean, and therefore could not have originated the forests once there, unless formerly of different value from now; but, if it be admitted that these non-forest causes vary, the deforesting may be due to natural changes, not to the hand of man.

Several seismoscopes and a series of photographs illustrating the effects of the Charleston earthquake, lent by the U. S. geological survey, were exhibited and explained at the meeting.

In the absence of the director, Professor Upton, an informal report on the work of the year was presented by the secretary. Members now number 110, against 95 last year, and include well-known meteorologists outside of New England. The monthly bulletin has been regularly issued, and recent numbers include reports from 140 to 151 observers, against 123 last year. More attention has been devoted to improving the character of the observations than to increasing the number of stations. Free tests of instruments belonging to observers reporting to the society have been begun by Prof. S. W. Holman. Three valued observers have been lost by death, — Hon. Hosea Doton, Woodstock, Vt.; Dr. B. F. Harrison, Wallingford, Conn.; and Mr. R. H. Gardiner, Gardiner, Me. The records of the last two will be continued. Special investigations, supported by grants from scientific funds, have been undertaken: a report on thunderstorms in New England in 1885, by the secretary, is thus already distributed to members; and a report on the distribution of rain in cyclonic storms, by the director, is now in press. While such special studies are generously supported, the society still needs to increase its membership for the support of its regular work.

PARIS LETTER.

M. CH. ZENGER recently made known, at a meeting of the Academy of sciences, some interesting facts concerning the singular property that different substances have of giving luminous rays in darkness after having been exposed to solar or even diffused light. M. Zenger remarked that Mont Blanc emits, till about half-past ten in the evening, a peculiar blue-green light, very similar to that given by Lake Leman; and he believed that this light originates in the ice of the glaciers as well as in the lime of the rocks. Thinking it might be possible to take a photograph of

the mountain by night, he spread on a plate of glass a thin layer of phosphor of Balmain, and put it in the camera, exactly as if it were a sensitive plate. After a few seconds, the plate was taken out of the camera, and left in the dark, in contact with an ordinary sensitive plate. An hour after, this last plate presented a good photograph of the view which had been focused upon the phosphorized plate. Believing that carbonate of lime can, by exposure to the rays of the sun, absorb some light and give it off in darkness, although these rays may not be perceptible to the eye, M. Zenger allowed a phosphorized plate to remain at the focus of a camera for a quarter of an hour, at midnight, on the terrace of the astronomical observatory of Prague. This plate was then left for some hours in contact with an ordinary photographic plate; and the result was very satisfactory, since the monuments and towers whose invisible image had been concentrated on the first plate in the camera, came out very well on the second. Another experiment was the following: a piece of white paper, with a picture or some words written or printed on it, was left in the sunlight for an hour and then put in the dark, in contact with ordinary sensitive paper. The experiment succeeded well, and M. Zenger has since used this system to copy bills and notes. Of course, black parts come out white, and white ones, black. The general result of M. Zenger's researches is, that many substances absorb luminous rays during the day, and at night emit these rays in such a manner as to be able to impress sensitive plates, although they do not impress the retina.

The smallest country in Europe is not the state of Monaco, nor the republics of San Marino or of Andorre, as many think: it is a yet smaller territory, whose name is hardly known outside of its narrow limits, and compared to which the above-mentioned states assume a gigantic appearance. The territory of Moresnet is about halfway between Verviers and Aachen, between Belgium and Germany. It comprises six square kilometres and two thousand inhabitants, and is situated in a very pretty valley. It is completely independent. Its wealth consists mainly in tin ore. In 1815, after the Napoleonic wars, a committee was appointed to establish the frontier between Germany and Belgium. All went right till Moresnet was approached. Here the delegates disagreed. Each wanted Moresnet for his country on account of the riches under ground. As no understanding could be arrived at, it was agreed that this strip of land should remain independent, and belong to neither country. At that time Moresnet was a beggarly collection of some fifty huts: at present, although still a very young state, it is in a prosperous condition, and comprises more than eight hundred houses. Agricultural and industrial pursuits are carried on to a considerable extent. It is governed by a mayor, or burgomaster, chosen by two delegates, — one German, and one Belgian. This imposing official — a prosperous and hearty farmer — has a second, an old doctor, and presides over an assembly of ten, chosen by himself. This assembly does all the business under his supervision. Nobody votes in Moresnet. There is no military service, and only six francs taxes. The revenue amounts to about twelve thousand francs, and is quite enough to pay for the roads, schools, and the military force, which comprises one man of undefined grade. It would seem that the mayor ought to be satisfied with the state of things. Not so, however: this ambitious man wants to find mineral waters in his territory. But none are to be found yet, so he consoles himself by manufacturing soda-water. Another of his ambitions is that Moresnet should stamp its own stamps, and have his effigy on them. But the delegates from Germany and Belgium do not see the use of the thing.

Unfortunately, fish-culture amounts to nothing in France. Nobody seems to take any interest in it, nor to realize how very useful and profitable it might be to all if the rivers and streams were cared for, and fishes reared, and protected while young. The French fisheries are very poor indeed, and it would require an intelligent and energetic man to call the attention of competent authorities to the fact, and try to secure their good-will. River and pond fisheries amount almost to nothing, but as yet the marine fisheries have been very prosperous. This year, however, sardines are very scarce. This fact is a very serious one, since some sixty thousand persons are occupied in the sardine-fisheries. It seems that this fish is prevented from following its natural course alongside the French coast, from Biarritz up to Brittany, by the Portuguese fishermen, who, it is said, as soon as the fish arrive from the south, spread large nets, many kilometres long, in their course, and so prevent them from going any farther. So they all turn back for a while, but some time after, they try to pass. This gives the Portuguese a second fishing-season. The fact is, that in Portugal the fisheries are very prosperous, and that sardines are sold this year at the rate of a franc and a half or two francs per thousand. In France they are so scarce that they range between six and eight francs (the small ones): fine sardines are sold at from thirty-five to forty-five francs per thousand.

A new balloon has been recently tested in Paris. It was built by an engineer whose name is not

yet made known. M. H. considers that it causes great loss of force to put the motor power in the basket, and that, if it were applied on the sides of the balloon, a great deal less would be required to give much more satisfactory results, as the power would act at the point where the resistance is greatest. So he has given his balloon a cigar-like shape, and, instead of a propeller underneath it, he has used a pair of wings on the sides of the balloon: they are put in motion by electricity, which is generated in the basket, and conducted by two wires to the wings. With this contrivance, M. H. believes he can obtain the same results as MM. Renard and Krebs, with less power. A public experiment, some days ago, gave, it seems, very satisfactory results, and the balloon was worked very well. Another balloon is being prepared, and M. H. is confident that it will be quite a success.

M. d'Arsouval, an able physiologist, and assistant to Dr. Brown-Sequard, published some time ago some interesting facts concerning the production of heat in muscular tissue. The fact that heat is developed when a muscle contracts, is well known. Many physiologists have made the experiment, which consists in a repeated and violent stimulation of the motor nerve, inducing tetanic spasms and a rise of temperature in the muscles. M. d'Arsouval has shown that it is not necessary to stimulate the nerve in such a manner as to induce tetanic spasms: weak stimulations, that do not bring on any contraction whatever, being too weak to do so, are accompanied by a thermic rise. Of course, the rise is not a high one, but it is measurable. M. d'Arsouval does not believe that the development of heat in organic bodies is a primary fact: on the contrary, he thinks that electricity is the first agency, and that heat results from the transformation. However, new experiments are necessary to ascertain this point.

M. L. Grandeau, the director of the agricultural station of Nancy, has recently published two interesting papers concerning a trip he made in Switzerland, during which he gave much attention to the agricultural productions of that country. There are in Switzerland some 30,000 square kilometres devoted to agricultural pursuits, 21,600 to pasture-land, 7,700 to forests, and 300 to vineyards. The greater part of the 21,600 is merely pasture-land (70 per cent): the remainder (30 per cent) is used to grow wheat. The pasture-land is used only for cattle-raising. Horses would not do well in Switzerland, on account of the climate. In Europe the increase of population has been much greater than that of meat-production. There is less meat to be had to-day per individual than there was fifty or sixty years ago. Cattle-raising is a profitable business, but it cannot yet become important enough in Switzerland to allow of exportation. If some cattle are exported, many more are imported: the excess of importation over exportation is fifty per cent, and more. As most Swiss peasants have only one or two cows (38,000 have only one, and 52,000 have three or four), an association system has been organized in many parts of Switzerland, after an old custom of Franche-Comte. It works as follows: some twenty or thirty peasants put their cows together in a herd, sending only as many as the lands they dispose of in the mountains can feed. A man is in charge of the herd, who every day milks the cows and cares for them, and makes the cheese during the summer season. When the cold sets in, the herd is brought down to the valley, and the cheeses are sold. The profits are distributed among the proprietors of the cows, according to the quantity of milk given by each of them. This quantity is carefully noted every day by the milkman. The result is, that, as cheese sells much better than milk, the benefits for each proprietor are nearly double what they would have been had the milk been sold as such. The whey is generally used to feed pigs, but of late it has been proposed to make milk-sugar from it. One litre of the whey contains some four or five grams of this sugar, which sells at one hundred or one hundred and ten francs per hundred kilograms. In Switzerland as well as elsewhere, the association system among small proprietors or producers proves very profitable and useful. M. Grandeau gave an interesting account of his visit to the Swiss works of the Anglo-Swiss condensed-milk company, built in the village of Cham by your countrymen MM. Page. The idea of condensing Swiss milk originated in 1866, and was put forth by M. G. Page, at that time American consul in Zurich. He imported the instruments in use in the states, and began immediately. In 1867 the milk was furnished by 263 cows, and the works prepared 137,000 cans of milk. In 1886, twenty years after the first start, the works of Cham condense the milk of 8,000 cows (60,000 litres per diem), and sell some 15,000,000 or 17,000,000 cans.

We hear from Bologna that a committee has just been appointed to celebrate the centennial of the discovery of animal electricity by Galvani. It is a pity that frogs cannot speak, for the speech their delegate would deliver on that occasion would be worth while hearing. From the day Galvani noticed the movements which put him on the scent of his discovery, to the present minute, how many of these unfortunate creatures have died cruel and lingering deaths! The balcony is yet shown in Bologna on which Galvani suspended his

frogs, and where he noticed for the first time the facts that led him to his fertile discovery.

M. Brown-Sequard delivered a communication on *rigor mortis* at the last meeting of the Academy of sciences. It is known that this phenomenon is generally ascribed to an hypothetical coagulation of myosin after death. Dr. Brown-Sequard shows, that, if blood is injected in rigid limbs, rigor disappears immediately, and appears again if the blood introduction ceases. This fact has been noticed by him, even twenty-eight days after death. If, during the first eight hours after death, a limb is maintained in a state of constant agitation by means of some mechanical contrivance, no rigidity appears. It is to be noted, also, that cadaverous rigidity does not affect nervous excitability. Dr. Brown-Sequard does not believe in the theory of myosin-coagulation, and thinks that muscular tissue retains, after death, a particular sort of vitality.

M. Succi, concerning whose fasting experiment I gave you some particulars in my last letter, has victoriously achieved his feat, and is getting on quite well. He intends to renew the experiment in Paris. However, he is not considered as much more than a humbug; and to persons of a scientific turn of mind his experiment does not seem to have been conducted in a serious manner. As E. de Cyon remarks in a short but 'telling' paper on the subject, there is no proof whatever that M. Succi has not been able to feed himself secretly.

Among new books I must say a word of the memoirs published during the competition for fellowships in the medical school. Some subjects are interesting; for instance, 'On progress of teratology since Geoffroy Saint Hilaire' (by Princeteau), 'Muscular work and heat' (by Tapie), 'The origin of heat and power in living organisms' (by Lambling), 'Alkaloids of animal origin' (by Hugounenq), 'Pigments and coloring-matters of animal economy' (by Villejean), 'Air' (by Morelle), 'Calorimetry and thermometry' (by Malosse). Generally speaking, these memoirs are good and substantial, and they give a good idea of the present state of science concerning the questions to which they refer.

The professors of the different schools are coming back to Paris, and preparing their winter work. In the medical school some considerable material changes are being made. The new laboratories are ready, in the new building in front of the medical school, and the professors entitled to occupy them are going to move their instruments and books. Professor Vulpian visited his laboratory the other day, and was happy to see that he was to benefit by the change. The fact is, that the old rooms he has occupied in some old houses close to the school these many years are quite inappropriate for laboratory work, space and light being very scarce. In the new building, although he will have nothing very extraordinary, he will be much better off. But our best French laboratories are small and inconvenient when compared to German ones. Nevertheless, France can boast of many great physiologists, such as Magendie, A. Bernard, Vulpian. Fine laboratories do not create genius, but they help a good deal in making work easier and more accurate.

V.

Paris, Oct. 15.

NOTES AND NEWS.

THE *Quarterly journal of economics*, announced by President Eliot of Harvard at the last commencement as having its origin in a fund of fifteen thousand dollars given to Harvard for the purpose by John E. Thayer, Esq., has appeared. While primarily an economic periodical, its prospectus does not exclude from treatment current topics in other branches of political and social science. In outward appearance the new *Quarterly* is very attractive, and the contents of this first issue are of excellent character and quality. Professor Dunbar, the editor, writes the opening article on 'The reaction in political economy.' To him "this movement appears to be no revolution, but a natural reaction, probably salutary, and destined to promote ultimately a rapid but still orderly development of the science, upon the lines laid down by the great masters of what is called the deductive school." In view of its historical and ethical aspect and its directing the attention of the economic world to new problems, Professor Dunbar thinks that the importance of this movement can hardly be overrated; but nevertheless it is not an absolute break, as is sometimes supposed, in the continuity of economic thought. The second article, by Mr. Arthur T. Hadley of Yale college, treats of 'Private monopolies and public rights.' It deals principally with the railroad problem. Mr. S. Dana Horton, whose reputation is international, writes learnedly and clearly on 'Silver before congress in 1886.' It is a strong argument for immediate action by congress in order to put an end to the 'present amorphous and anomalous state of affairs.' Following the leading articles come valuable notes and memoranda, and an interesting letter on economics in France by Arthur Mangin. The bibliography for the quarter is appended, carefully classified, and in an appendix is included a partial translation of Wagner's review of Cohn's 'System der nationalökonomie,' from a late number of the *Jahrbücher für national-ökonomie u. statistik*. The first number is in every way commendable, and we can

heartily congratulate all students and readers in the great fields of political and social science that it has been found possible to found in a single year two American quarterlies to deal with those subjects, and both of the highest order of merit.

— A hand-book of school superintendents, for 1886 and 1887, has been issued by The writers' publishing company, No. 21 University place, New York.

— In the last number of the *Philosophische monatschrifte*, Professor Schaarschmidt announces that Professor Natorp of Marburg will hereafter be associated with him in the conduct of that journal.

— 'A manual of lithology,' by E. H. Williams, jun. (New York, *Wiley*, 1886), may be of value to engineers and others who wish to know something of the names and composition of the commonest rocks in a superficial way; but its title, 'A manual of lithology,' is certainly not warranted by any thing which it contains. The author regards only the macroscopical characters of minerals and rocks, which modern students know are, by themselves, most unsatisfactory and often misleading. After a few preliminary definitions, the commonest rock-forming minerals are mentioned, and a few of their characters given with more or less accuracy in tabular form. Then follows an enumeration of the principal rock-types, with the briefest possible description of each. The nomenclature here is quite antiquated, and employed apparently with no knowledge of the recent advances in petrographical science. The author's difficulty in distinguishing between crystalline and amorphous bodies leads him throughout the work into curious blunders. Why the peridotite rocks should have been placed in the group of 'special rocks,' it is difficult to see. Altogether this little book is very unsatisfactory, even for the extremely limited field which it attempts to cover.

— A fatal case of poisoning by bisulphide of carbon has recently occurred in England. The patient was a shoemaker, who was under the influence of liquor at the time that he drank the poisonous liquid. Although a physician was in attendance within fifteen minutes after the bisulphide was taken, and applied the proper treatment, the man died in two hours.

— A correspondent of the *British medical journal*, who has had large experience in the treatment of hydrophobia, says that the usual duration of the disease, from the time of attack to death, is from three to five days. He had but little difficulty in administering liquids, if they were of a dark color, and given from a vessel which was not transparent, so that the contents would not be seen until the vessel was placed to the lips.

— Dr. Joseph Jones of New Orleans recommends most highly the drinking of large quantities of fresh milk in cases of arsenical poisoning. His explanation of its action is, that it dilutes the poison, encloses it in its coagula, sheathes the inflamed surface of the mucous membrane, and, when the stomach is capable of absorption and digestion, it forms an aliment of the greatest value. His experience includes more than thirteen cases, all of which recovered.

— Dr. Morse of Amissville, Va., claims to have treated one hundred and twenty-five cases of diphtheria without a fatal result in a single case. Although he employs other remedies as adjuvants, he attributes his success to bicarbonate of potassium, which he gives to an adult in doses of from ten to twenty grains every two hours, with the view of saturating the system as soon as possible.

— A student at an Arkansas college, while making hydrogen gas, applied a match to the tube from which the gas was escaping, and, the air not having been expelled, an explosion followed which burst the retort, the pieces of glass flying in all directions. One of the student's eyes was injured at the time; and as the trouble was lately increasing, the eye having in the mean while become blind, and as it was feared the sound eye might be sympathetically affected, the diseased eye was removed, and embedded in the tissues was found a piece of glass 15 millimetres long, 12 wide, and 1½ thick.

— The Marchant steam-engine, now being introduced in England, shows a remarkable advance in efficiency, unless there be some undiscovered source of error in recent tests made. According to reports published in the London *Electrical review*, in a run of six hours and a half the engine developed ninety-eight horse-power upon a consumption of fuel of 77.54 pounds of coal per hour, or 0.791 of a pound of coal per horse-power hour. The accuracy of the methods employed in making the tests has been questioned by experts, and the resulting controversy will only be ended by further and more extended tests under conditions satisfactory to all. The action of the engine is as follows: the steam, at its initial pressure, passes from the boiler to the high-pressure cylinder, whence one third of the steam is taken to the low-pressure cylinder, expands, does its work, and is exhausted into the vacuum maintained in the condenser, converted into water, and finally conducted to the pumps as feed-water; the other

two thirds of steam, on leaving the high-pressure cylinder, passes into another, is expanded at two-thirds the stroke, and, having exerted its power, proceeds to a pump, where it is again expanded. After this the two-thirds steam is compressed in the last pump into the one-third feed-water; this latter process is carried on at the expense of engine-power, which is exerted not only in forcing the steam into the feed-water, but in compressing a cushion of air maintained at a proper pressure by means of air-pumps. This cushion or air-spring, on the return stroke, renders up its stored energy by pushing or returning the combined feed of steam and water back to the boiler.

— The next meeting of the Indiana academy of sciences will be held at Indianapolis, Dec. 29. It is proposed that the papers presented to the academy be grouped according to the topic; that is, that all papers upon geology be brought together, and all upon biology, etc. Those who desire to present papers should, at their earliest convenience, send the titles of their communications to the secretary, Mr. Amos W. Butler, Brookville, Franklin county, Ind.

— The new U. S. cruiser Boston. Mr. Gould's yacht Atalanta, and Mr. Vanderbilt's yacht Alva, are to be furnished with dense-air ice-machines, which are now being built at the Delamater iron-works in this city. In these machines, which require no chemicals, the air is compressed and expanded between the limits of twelve and four atmospheres' pressure, being used over and over again in what is called a 'closed cycle.' In the ordinary cold-air ice-machines the air is compressed and expanded between the limits of the normal atmospheric density and three or four atmospheres. The lower limit of density in the new machines — four atmospheres — is produced and maintained by a small auxiliary air-pump, which is automatically thrown out of action when the proper pressure is reached, resuming again when, through leakage, the pressure is reduced. It is said that with these machines ice may be produced at a cost of two dollars per ton.

— The electric motor is destined to play an important part in the history of railroads in this as well as other countries. Although not yet out of the experimental stage, electric street railways are rapidly gaining ground in public favor. Chicago, Baltimore, Philadelphia, Minneapolis, Toronto, and other cities already have electric street-railways in successful and profitable operation. About a dozen new roads are in course of construction, and a score or two more are projected. Montgomery, Ala., will be the first city in the world to have a complete electric street-railway system. In this city it is expected that a new and powerful Daft electric motor will soon be making trial trips on the Ninth Avenue elevated road, hauling a train of four or five cars; and on a branch of the Third Avenue road a passenger-car equipped with Sprague motors has been making experimental trips during a great part of the summer.

— The contributions to the mineral wealth of the world from the mines of Victoria, Australia, up to the beginning of the present year, show the very respectable total value of $1,052,635,824. This is divided as follows: gold, $1,047,129,274; tin, $3,239,524; copper, $920,000; antimony, $824,466; silver, $350,840; coal, $84,738; iron, $61,045; lead, $25,937. During the past year there was a total of 26,192 persons engaged in mining in Victoria, of which number 4,950 were Chinese. It is noticeable that of the latter there were only 202 engaged in quartz-mining, the rest working at the alluvial or placer diggings.

— The tincture of the chloride of iron, diluted with water, is very generally used as a tonic. Recent experiments have shown that when thus diluted it acts very injuriously upon the teeth. This is explained by the fact that the peroxide formed in the alcoholic solution is precipitated when water is present in such a flocculent form as not to adhere to the surface of the teeth, and consequently the free hydrochloric acid can act upon the lime salts of the teeth without let or hinderance. When the tincture is given without water, no action takes place; the peroxide which is then formed is of the anhydrous form, and so compact as to adhere to the teeth, and protect them from the action of the acid. These experiments have resulted in determining that there are three menstrua which can be used as diluents of this tincture, which will produce no injurious effects upon the teeth: they are alcohol in some form, vichy water, and a simple sirup.

— Professor Legge states that he has found two embryos in a single blastoderm in a fowl's egg at the third day of incubation.

— A remarkable death has recently occurred in Paris, in which the cause would never have been discovered had not an autopsy been held. A young girl was found dead in the street, and was at first supposed to have been the victim of foul play. When the post-mortem examination was held, the larynx was found to be closed by lumbricoid worms, which had been vomited, but had not been ejected from the mouth.

— The report of the director of the Leander McCormick observatory of the University of Virginia,

for the year ending June 1, 1886, states that the great equatorial has been chiefly employed in the examination and sketching of southern nebulae. The nebula in Orion, and the Trifid and Omego nebulae have received special attention. 351 observations of miscellaneous nebulae have been made, resulting in 226 drawings, and the discovery of 233 nebulae which are supposed not to have been hitherto detected. Only a few nights have been suited to the micrometrical measurement of double stars; 76 observations have, however, been made. Observations of three comets have been made. Tuttle's comet was observed at only one other observatory, Nice, in France; and Barnard's comet of 1886 was observed at this place three weeks later than elsewhere. The small equatorial has been employed in revising the catalogue of stars south of 23°. The observations for the revision of the 23° zone are now practically completed. The director, Ormond Stone, expresses the opinion that the past year has been, without exception, the poorest for astronomical observations which he has ever known. Not only have there been an unusual number of cloudy nights, but even on clear nights the definition has been almost always extremely poor.

— An interesting combination of the Coulier-Aitken theory of the control of dust on cloud-formation with Thomson's investigation of the effect of surface form on evaporation has lately been made by Dr. Robert v. Helmholz. He finds that a definite and perceptible cooling of a mass of moist air below its dew-point is needed before any condensation begins, and ascribes this to the facility with which the first-formed water-droplets would evaporate on account of their sharply curved surfaces; so that super-saturation is needed to begin their formation. At the same time, the degree of super-saturation ordinarily needed is less than that required in dust-free air, because the dust particles diminish the surface-curvature of a given minute volume of water; and also, at the beginning of condensation, the particles may prevent evaporation from the surface of water that is attached to them. Filtered air has been carried to tenfold super-saturation without a trace of mistiness.

LETTERS TO THE EDITOR.

****Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Ely's Labor movement in America.

ALTHOUGH I have never before written any thing in reply to the censures of a reviewer, I feel moved to say a few words about the critique of my 'Labor movement in America' which appeared in *Science* for Oct. 15.

There are several reasons for this departure from my ordinary course. First, other authors have established the precedent, and *Science* has already published statements in reply to severe criticism of a book. While an author should doubtless decline to discuss his own capacity or general qualifications for his task, it may be very proper for him to call attention to positive misstatements of his reviewers. I am inclined to think it desirable that this should become general, as it would perhaps lead people to read a book carefully before reviewing it, — a thing which may be regarded as exceptional at present. Second, while it is doubtless not worth while to notice those who fail to distinguish between a torrent of personal abuse and serious criticism, it cannot be incompatible with one's self-respect to point out the errors of fact in a critique written by a person like N. M. B., who evidently desires simply to give expression to truth, and not to vilify an author. Third, a review is read by many who never see the book reviewed; and it may even be my duty to correct serious misapprehensions to which the article by N. M. B. must give rise, especially as they relate to such grave and pressing problems of the hour.

N. M. B. says that I seem to uphold "the extremists in their contention that all the evils of the present state of society are due to private property and the lack of proper co-operation in production and distribution." This is simply inconceivable to me; for the exact opposite is stated, I think I may safely say, fifty times in the book reviewed. I can find no more rational explanation for this astounding assertion of N. M. B. than that during a nap between chapters it came to him in a dream. If I held the opinion attributed to me, the remedy for social evils would be the abolition of private property; in other words, the socialistic programme. Is it not a little strange, that, with one exception, the sharpest attack on the book should have appeared in the organ of the socialistic labor party, while other reviewers complain because I leave nearly every thing to sympathy and benevolence, and furnish no adequate room for the activity of the state? The truth is, I point out many causes for the evils of present society, as intemperance, imperfect ethical development of man (which N. M. B. acknowledges, thereby falling into self-contradiction), unchastity, ignorance of the simplest laws of political economy, extravagance, and, in fact, 'the wickedness of human nature.' When, in his reproof of me because I failed to see so deeply as an ancient sage, N. M. B. goes on to ask labor agitators and 'their allies among professed political economists' whether the social, political, economic, and ethical elevation of men at large, and the human nature that is in them, is not what is wanted, he repeats my own words. I have dwelt at length on this point because I regard the accusation brought against me as a serious one. While I would not reproach N. M. B. with malevolence, I do bring against him the charge of culpable negligence. This is not the only case where the reviewer dwells on objections to the programmes of labor organizations, which I have pointed out, in such manner as to convey the impression that I have failed to see them. He does this in the discussion of the financial platform of the knights of labor. N. M. B. still labors under the delusion that men in masses in this country strike, and do all sorts of dreadful things, because some one 'snaps his fingers.' No doubt, he has read it in his daily paper; but for a man of scientific pretensions to repeat it, shows a strange ignorance of human nature and of the operations of the mind of

man. A knowledge of natural phenomena is now regarded as a necessary qualification in a man who would instruct others in natural sciences. At some future time a knowledge of social and industrial phenomena will be considered a desirable qualification in a writer on economic topics: when that happy time comes, we will hear less about 'some one snapping his fingers' and turning the world upside down.

Only one other point. N. M. B. says I gather facts to suit a preconceived theory. If he had read the book more carefully, he would have learned the true state of the case; namely, that I began my investigation with a theory opposed to labor organizations, but was converted from my former opinion by an overwhelming and irresistible array of facts disclosed by serious investigation.

N. M. B. is not the only one who exhibits gross carelessness in reviews. The fault is common; and my own conscience pricks me when I remember one critique which I wrote several years ago. But it is time to emphasize the duty which a reviewer owes not merely to the author, but to the general public, to master the contents of a book before presenting an estimate of it to the world. RICHARD T. ELY.

Johns Hopkins university,
Baltimore, Oct. 22.

In a criticism of Professor Ely's 'Labor movement in America,' by N. M. B., in your issue of Oct. 15, it is stated that the evils which socialists ascribe to 'the institution of private property' are not the true cause of the evils or labor troubles, but that they are caused, as Aristotle held, by the 'wickedness of human nature.' No standard for good and bad is given by N. M. B., and the reader is left at a loss what 'wickedness' may be according to Aristotle or N. M. B. It is fair to presume that selfishness — utter, brutal, unmodified selfishness, the mere following out of the brutal, selfish instincts of man, regardless of the welfare or interest of other selves — is what Aristotle and N. M. B. mean.

"Every one for himself, the devil take the hindmost," is, then, the expression of the greatest wickedness or worst trait of human nature: that is individualism, pure and simple. Opposed to that, on the other extreme, as absolute goodness, would be altruism. Between the two, as the golden mean, is equity, or socialism, — live and let live; each for all, and all for each. The history or evolution of human nature — that is, the ego-altruistic or ethical part of human nature — is simply a development from the utter selfishness of the lowest brutes to the social instinct of man. That is the very thing that makes man, or the human character of the animal man. As man develops from a mere individualist, he becomes, therefore, better according to the degree in which he develops his social or equity nature; that is, as he grows to be a socialist That answers Mr. N. M. B.'s question, whether these labor agitators consider it is the wickedness (total depravity ?) of man that needs to be reformed, or the economic-social institutions. The answer is, Both. Human nature has developed already from a low, beastly, selfish savage, to a golden-rule man; but our economic institutions are not yet brought into accord with that development of our human nature. To do that is the work and objects of the socialistic agitators. When that is done, it will again have a reflex action on our nature (like all material environment or social institutions), and help to make human nature still better than it now is.

ONE OF THE AGITATORS.

On the figures illustrating zoölogical literature.

When a zoölogist takes up his pen, brush, or pencil with the intention of executing a drawing of a zoölogical subject, either new or old, with the view of publishing it to the world, he assumes, in my opinion, one of the greatest responsibilities that can fall to the lot of man. This responsibility is none the less, of course, when the zoölogist is obliged to review the work done for him in this way by others, and applies to all manner of figurative illustration for zoölogical literature. On the other hand, I think science is fully as much in debt to him who furnishes her literature with an absolutely accurate, clear, and instructive figure, as she is to the writer who produces in type a full, trustworthy, and comprehensive description of the same subject. And, indeed, in many particulars, a good drawing of any object in nature, in the vast majority of cases, leaves a much more lasting impression upon the mind of the student than does sometimes the most lucid of descriptions. For instance, if we had never seen an elephant, nor a good figure of one, how different would be the ideas of different persons, were they to attempt to draw an elephant simply from a description, however good that description might be! How important it is, then, that original figures in zoölogy, including all its branches, should be as perfect and correct likenesses of the object they depict, as possible!

The writer, who has thus far contributed some thousand original drawings to the various departments of zoölogy, feels that no one more than himself needs the greatness of this responsibility laid before him, and I am fully aware of the shortcomings of some of my early attempts; but, be it said in justice to myself, I believe at the present writing duplicates, either in press or in the hands of publishers, of all of those that evidently required special improvement, are now furnished.

Great encouragement is held out in the future to all naturalists, in the numerous methods that are being perfected, by means of which the originals are accurately transferred to metal without the interference of another hand; and more especially does this encouragement come to those naturalists who take great pains, and are skilful with their work.

Electrotypy, however, and the ease it affords for reproducing all manner of work, threaten such scientists and naturalists who illustrate their own writings, with another danger, for which steps must soon be taken to protect them. This danger comes more especially from that class of writers who are either indifferent artists or will not take the time to make their own figures. Such people are apt to become very lax in the principles which pertain even to the matter of courtesy in the premises, and often, without your leave or by your leave, copy the drawings of others by electrotypy to illustrate their own books, which latter are only too often hastily made in other particulars.

And should an author have his writings and carefully executed drawings come out from the government press, why then these people to whom I allude seem to think that they are under no obligation of any kind whatever, and immediately plunder any thing they see fit to use. This is a great injustice to the original artist and describer: for in time it is sure to rob him of his right, as government publications are rarely seen by the public at large; and the first thing he knows his unacknowledged draw-

ings are in use in class-books in half the schools in the country.

Then, again, it may operate in some such way as this. Take Professor Coues's first edition of his 'Key to North American birds.' This author says in his preface, "Professor Baird kindly offered me the use of all the illustrations of his late review, while Professor Agassiz generously placed at my disposal the plates accompanying Mr. Allen's 'Memoir on the birds of Florida.' Several of the woodcuts have been taken from Professor Tenny's 'Manual of zoölogy,' with the author's permission; and a few others have been contributed by Messrs. Lee & Shepard. With a few exceptions, the rest of the illustrations have been drawn from nature by the author, and engraved by Mr. C. A. Walker."

Now, here is a work illustrated by 238 figures, 40 of which at least are due to the unequalled genius of Audubon and Wilson; and yet their names are not even so much as mentioned in the preface, or anywhere else in the book, in connection with its illustrations! I will say here in justice to Coues, however, that he amply corrected this in the second edition of his 'Key;' but how does it operate? Why, this way: six or seven years afterwards Prof. A. S. Packard publishes a work entitled 'Zoölogy,' wherein the chapter devoted to birds has 22 figures, at least 14 of which are reduced cuts from either Audubon or Wilson, but each one accredited as being "from Coues's 'Key.'" I hold this to be altogether wrong, and a great injustice to an author or artist naturalist, either living or dead. It is quite as easy to write fig. 465, "Summer duck — from Coues's 'Key,' after Audubon," because that perpetuates the genius of a great artist, and relieves Dr. Coues of the responsibility of having drawn the bird in question!

Foreign authors are exceedingly careful about such matters in their educational works upon biology, for they seem to appreciate the fact that to be otherwise is taking, to say the very least of it, an unfair advantage of a special worker in science, who may not care to publish 'Nature series' for the public. The very recent and admirable publications of Mivart, Claus (A. Sedgwick's translation), Wiedersheim (W. N. Parker's translation), and F. Jeffrey Bell, will bear me out in this.

On the other hand, some of our American authors fully deserve the sharpest of criticism for their carelessness in such matters, and in other cases more severe handling where it actually comes within the operation of the law.

As an example of the majority of the suggestions and views that I have just put forth, let us take a little work just gotten out by Professor Packard for the use of American youth in the schools, and a sort of first steps in zoölogy (steps surely that should be, above all others, in the right direction). I refer to the 'First lessons in zoölogy' (New York, *Holt*). In the present connection, I have nothing to do with the long list of misstatements in biology in this apparently very hastily written book, but draw upon it solely to illustrate what I have said about zoölogical figures.

Dr. Packard, in its preface, makes a very shiftless acknowledgment of some of the authorities for the illustrations, but leaves a very much larger number where he has completely ignored the artists, and finally says that eight of them were drawn by himself; trusting, I presume, that the students would choose from among the most trustworthy and best of the unacknowledged ones these eight, and accredit the author with them.

I observe among several others quite a number of the wonderfully instructive drawings of Prof. E. S. Morse, some of C. V. Riley's, two of my own (figs. 196, 197), a drawing by Coues (fig. 203), and others by Hornaday, Rymer Jones, Owen, and many others, none of which receive a single word of acknowledgment as being authority for the originals.

But now a word as to some of the drawings themselves, — illustrations that are to be presented to classes of our children, and from which they are supposed to gain or derive their *first* notions of animal forms. Take fig. 211, for example, said to be a 'head of a dove,' but of rather a raptorial variety, I should mildly suggest. Fig. 212, on the same page, looks, to my mind, far more like the claw of a young lobster than the head of a cockatoo, which it is intended to represent. There is hardly a schoolboy in America, who has ever given sufficient attention to the matter, who would not know at a glance that the 'Lobate foot of the coot' (fig. 208) is absolutely incorrect in important particulars.

As the author says in the preface that it has been 'copied by electrotypy,' I do not know the authority for the skeleton of the wild ass (fig. 251), but it certainly gives the impression that the symphysis of the pelvis is not joined, and it strikes me that a better and far safer illustration of the mammalian skeleton could have been chosen to meet the end in view. But enough; for I believe I have fairly shown that surely these are not the characters of trustworthy illustrations of zoölogical subjects to bring into the class-room. And I must believe that if any of the youthful students of this little work become naturalists by profession in after-life, and look back upon the drawings I have cited, they will agree with Professor Packard, as he expresses himself on its p. 142, and with myself, after I had seen the figures in question, that, "even after the lancelet came into being, the steps by which the genuine backboned family became recognized in animal society were painful, and only in a degree successful."

R. W. SHUFELDT.

Fort Wingate, N. Mex., Oct. 9.

The Charleston earthquake.

I suggest an experiment which will, I think, clear up the ideas of many persons who may witness it, as to the source of the phenomena of the Charleston earthquake.

Let a large sheet of glass (thick plate-glass is perhaps best) be held in a position nearly horizontal. Place an alcohol-lamp beneath it, near enough to heat it. Long before it is hot enough to soften, it will visibly bend, and then break with noise and more or less shock. It will be violently agitated.

To apply this, suppose that dense strata of rock exist at a great depth below the earth's surface, underlying the coast region from the Alleghanies far out under the ocean; that in the course of ages portions of these sheets hundreds of feet thick, hundreds of miles wide, and perhaps a thousand miles long, have been slowly increasing in temperature, and expanding or endeavoring to expand. For a long time, and to a considerable amount of expansion over such large areas, the tendency to expand merely makes the rock denser; i.e., sets up internal strains, compressing the substance of the rock as confined — a mile square of it, fifty miles square of it — to the

actual space it has occupied for ages. This rock is like hard glass, elastic, which involves compressibility. At last the compressive stress accumulating for ages becomes too great to be borne without relief, which can come only from fracture.

The fracture, once started, extends from its initial point in lines of dislocation, as is in cold countries constantly observed in the thick ice covering lakes, and as is seen in the heated pane of glass.

But the commotion, the shock, the rending, the noises, are infinitely greater than in the case of the pane of glass or the sheet of ice. In the sudden splitting, rending and jarring dislocation of the glass, we have the working model of the heated strata of rock. If the effect bears any proportion to the relative magnitude of the model and the rock, then we have force, stress, movement, noise enough to produce all the audible and visible effects of the Charleston earthquakes.

The sudden dislocation and displacement under Charleston may produce the local shock; the noise of the sudden splitting of the rock in place, the sound like distant cannon-shot. The long roar and grinding, like ten thousand rusty iron chariots on a rocky road, may be due to the production of a crack, which, if ten miles long, and instantaneous throughout its whole length, would yet be heard only as the sound from each foot of its length arrived at the ear of the hearer. The sound produced under foot might be heard within a few seconds; and that produced fifty or sixty thousand feet away, say ten miles, would not reach the ear till it was fifty or sixty seconds old; and, as the sound of successive portions breaking at different distances arrived, there would result a continuous and heavy roar. Such a dislocation would relieve in great measure the general, the widely diffused stress and strain. But movements would be local as well as general, and the smaller but still immense sections of our stratum of rock might continue for days and weeks to adjust themselves by smaller cracks, crushings, and dislocations, producing the lesser shocks, sounds, and roars which commonly follow the first and greatest disturbance. Such have followed that of Charleston and Summerville. In fact, the pane of thick glass breaking over the flame of an alcohol-lamp in the laboratory or on the lecture-table seems to give a working model, illustrating all the known and reported phenomena of the Charleston earthquake. The heat supposed to be observed by some in the ejection of water and mud may well have come from the sudden compression and stresses set up in the moment of dislocation. Sudden shocks, compressive stresses, and motion arrested, produce heat, as, when a fifteen-inch cast-iron ball at great velocity breaks to pieces against an iron target, its scattered fragments are all hot to the hand that gathers them. Ten miles square of hard limestone, if heated 10°, would expand three feet in length and width if free to move; heated 100°, it would expand about thirty feet each way. Here are force and movement enough to wreck a dozen Charlestons. All we need on this theory is a change of temperature not very great nor rapid.

Such changes are plainly registered in the famous three columns of Pozzuoli described by Lyell, which, having been erected above the level of the ocean, have, two or three times within the historic period, sunk below its surface, and been bored at various levels by stone-boring shell-fish (Simaceae saxophagi), and then risen again till these marks, undoubtedly made under water, are now above the water, which merely bathes the floor of the temple, and on which they still stand upright, as though never disturbed. Lyell's clear description assigns these evident changes of level to local changes of temperature in the crust of the earth below Pozzuoli. Visible motion and fracture of rocks also accompany the phenomena of 'creeping' in coal-mines.

M. C. Meigs.

Washington, D.C., Oct. 20.

Sea-level and ocean-currents.

I have just received a letter from my friend, Capt. John Brown, son of John Brown the martyr, which I have thought would interest your readers in itself, and furnish a better illustration than I have before given of the power of wind-friction to move great bodies of water. I therefore enclose you the following copy: —

Put-in Bay Is., Oct. 16, 1886.

My dear friend, — At 11 o'clock Thursday evening, the 14th inst., I witnessed here a remarkable fact, the effect of the late tremendous wind-storm. This commenced about 7 A.M., and began to let up at 11 o'clock in the evening, or a little later. I then went down to the shore in front of my house, and found the lake lower than the average by fully six feet! This is the greatest depression from such cause I have noticed during a residence here of nearly twenty-four years. We have not, within this period, had such a high wind steadily continued for so long a time.

The captain of the steamer Chief Justice Waite, running between Toledo and the islands, reports the fall of water-level at Toledo as about eight feet.

Ever yours, John Brown, Jr.

The reply of Mr. Ferrel, contained in *Science* of July 30, seems to me to obscure rather than illuminate the subject it discusses. The question before us is, not whether the wind has the power of raising the water-level on a coast, but whether wind-friction can, in the great equatorial belt and in the track of the Gulf Stream, produce the flow of water which is there observed. The striking cases of the power of wind to heap water on coasts, and to move bodily great masses of it in lakes, are only interesting and relevant as demonstrating the sufficiency of wind-friction to produce broad and rapid surface-currents. This conceded, and the case is won, because, in the lakes and open ocean, like causes produce like effects. Wind of given velocity raises in both places waves of equal height in equal times: against these waves the wind presses in the direction of its flow, with no opposing force. As a consequence, the roughened water-surface, from greatly increased friction, is moved bodily forward just as though impelled by the paddles of a revolving wheel. This surface-flow is in time communicated to underlying strata, and, if the wind continue to blow in the same direction, ultimately a large body of water will be set in motion; in other words, an ocean-current will be produced. There is no escape from this conclusion; and all that part of Mr. Ferrel's paper which relates to wind-velocities, gradients, cross-sections, etc., are irrelevant. The great truth remains, that wind-friction can produce ocean-currents. The difference in specific gravity between cold arctic and warm tropical water is undoubtedly also a *vera causa*, the only difference between Mr. Ferrel and myself being as to the relative value of these two factors. Impressed as I am with

the palpable evidence of the tremendous efficiency of wind-friction, and realizing the extreme slowness of readjustment of disturbed equilibrium by a slight difference of specific gravity, the other factor, I am compelled to give in my adhesion to the party, very respectable in numbers and intelligence, who ascribe the greater efficiency to the friction of wind.

So far as the surface-gradients of the ocean are concerned, I must say that I regard them of no significance in this discussion. One has only to turn to Dr. Penk's 'Die schwankungen des meeresspiegels,' and read the record which he and the authorities he quotes have made, to see that along the coast sea-level is altogether a local phenomenon, and is dependent upon the altitude and position of the neighboring land-masses. Where the shores are lofty mountains, there the water attracted by them rises above the normal; it also rises on both sides of the Atlantic, and is probably ten or twelve feet lower in the middle than on either side.

J. S. NEWBERRY.

The genesis of the diamond.

Prof. Carvill Lewis, in his remarks on 'The genesis of the diamond' (*Science*, viii. p. 345), briefly alludes to the peridotite of Elliott county, Ky., as 'suggesting interesting possibilities.' My notes (*American journal of science*, August, 1886, p. 121) on this remarkable eruptive rock are but a brief digest of a report (Bulletin No. 38, U. S. geological survey, not yet published) in which its peculiar features are more completely described. If the hypothesis advanced by Professor Lewis really accords with nature's method of manufacturing this precious gem, it gives to prospectors a most valuable guide; and it is well worth while to carefully examine all localities the geological composition and history of which are analogous to that of the South African diamond-fields.

In Elliott county, Ky., near Isom's mill, six miles south-west of Willard, there are two short dikes of peridotite breaking through the horizontal sandstones and shales of carboniferous age in such a manner as to locally envelop many of their fragments. The slopes in the vicinity are well covered with soil, so that there are but few exposures of either the intrusive mass or the adjacent strata near the line of contact between them; and no considerable excavations have been made. Nevertheless it is evident that the shales have been distinctly metamorphosed by the peridotite. This is most plainly visible in the enveloped fragments of shale, which are quite numerous in the dike at one exposure near Isom's mill, but elsewhere they are almost or entirely absent. Thus both varieties of peridotite described by Professor Lewis occur in Kentucky, but the brecciated form has not yet been found to contain diamonds.

The dark shale, fragments of which are included in the peridotite, may be regarded as composed of sand and clay in varying proportions. The amount of metamorphism experienced by the small fragments of shale is very unequal, and by no means proportional to the sizes of the inclusions. One of the earliest and predominant metamorphic effects is the development of a micaceous mineral in the argillaceous cement. This development may extend so far as to render the inclusion chiefly micaceous. Each enveloped fragment is surrounded by a narrow zone of colorless mica, the scales of which are frequently arranged perpendicular to its surface. An advanced stage of metamorphism is marked by the appearance of very interesting spheroidal bodies with remarkably suggestive properties. They have a high index of refraction, and are pale yellowish to colorless, translucent to almost transparent, and completely isotropic. The diameter of these little globules is generally about .02 of a millimetre, and they are remarkably uniform in size. Rarely this substance appears in irregular grains; but generally it occurs in a form very suggestive of the diamond, for it resembles a hexoctahedron with curved faces. In general appearance it simulates the small translucent crystals of octahedrite in the adjacent peridotite, but their optical properties and action in acids readily distinguish it from that species. They are soluble in concentrated hydrochloric acid, and, when heated to bright redness, they become less translucent and somewhat earthy in appearance; but the change is not prominent. In the small fragments the globules are usually numerous, and scattered throughout the scales of clouded mica, but most abundant and least regular in form near the periphery of the inclusion, where they sometimes form quite a distinct border just inside the one of colorless mica. In the fragments where this peculiar isotropic substance is most abundant, there is but little well-developed mica. Notwithstanding the fact that some of their properties suggest that they are diamonds more or less perfectly crystallized, their solubility in acid renders such a view untenable. Were they diamonds, they would be of comparatively little value, because of their exceedingly small size.

The dark shale which is frequently enveloped by the peridotite is somewhat carbonaceous, but contains a small proportion of carbon as compared with that of the South African diamond-field: for this reason, it appears to me rather improbable that diamonds will be discovered at the locality in question.

Some very pretty pyropes, locally supposed to be rubies, have been picked up in the soil resulting from the decomposition and disintegration of the peridotite, but nothing of greater value has yet been discovered at that place. That the dikes have been prospected, and supposed to contain valuable metals, is evidenced not only by slight excavations, but also by the ruins of what appears to have been a structure for reducing ore. Nothing is known in that country of the history of these ruins, and they may be of considerable antiquity.

It appears to be a significant fact in favor of Professor Lewis's hypothesis, that the diamonds found in the United States have been discovered where peridotites abound. The chief localities are either in North Carolina and Georgia or in California. Of all the mountain-ranges of this country, the northern portion of the Sierras in California is perhaps the richest in serpentine. In cases I have examined, the serpentine is derived by alteration from peridotites. In the same region, among older stratified rocks of the auriferous series, is a black shale or slate which occasionally contains a considerable amount of carbonaceous matter; and it is quite possible that the diamonds which have been discovered in the Sierras had their origin along a contact between peridotite and carbonaceous shale. At any rate, the suggestion opens another field for prospectors, and it should be remembered that corundum, with its gems, is also found under similar geologic conditions.

J. S. DILLER.

Petrographic laboratory, U. S. geol. surv.,
Washington, D.C., Oct. 21.

SCIENCE.—SUPPLEMENT.

FRIDAY, OCTOBER 29, 1886.

PRELIMINARY NOTE OF AN ANALYSIS OF THE MEXICAN CODICES AND GRAVEN INSCRIPTIONS.[1]

I WISH to make a statement of a few of the results I have recently obtained by a translation into the Nahuatl language of the phonetic symbols contained in the Vienna codex and the Bodleian and Selden manuscripts. I find that these entire codices are composed of signs representing parts of speech, forming, in combination, words and sentences. Moreover, I have discovered certain determinative signs that render a misinterpretation of these picture-writings impossible.

The Vienna codex, the Bodleian and Selden manuscripts, are records of lands, tributes, tithes, and taxes. A partial decipherment of portions of the Borgian, Vatican, and Fejérvary codices convinces me that these do not relate, as has been supposed and is maintained, to astrological and exclusively religious matters, but deal with the details of a communal form of government, the existence of which has been suggested by some recent writers, but not sufficiently proved to be generally accepted.

The as yet imperfect insight I have obtained through these native works confirms and completes much of the testimony of the early Spanish writers, but also renders evident the false and distorted impressions they received and handed down.

Familiarity with certain phonetic symbols of frequent recurrence in the picture-writings caused me to perceive, somewhat to my astonishment, that identical symbols are reproduced on the so-called 'calendar stone,' the 'sacrificial stone,' and other equally well known monoliths. Through the decipherment of these and an application of the same method to other symbols engraved thereon, I unhesitatingly affirm, even at this early stage of investigation, that these graven monoliths are not what they have hitherto been considered. On them are Nahuatl words that are found in the codices in Sahagun's invaluable 'Historia,' and in other early chronicles where imperfect explanations of them are given; and these words reveal, beyond doubt, the true uses and purposes of the stones.

[1] Read before the American association for the advancement of science at Buffalo, August, 1886.

Let us cursorily examine the testimony of the best authorities on a certain point. Duran tells us distinctly that there was in each market-place of ancient Mexico a circular, elaborately carved tablet, held in great veneration. It was frequently consulted, and by it the market-days were regulated. All writers concur in stating that the market was held on each fifth day. According to them, a period of five days answered to our week, and four such divisions formed the period of twenty days termed the Mexican month. They tell us that all adults were obliged by law to resort to the appointed market-place on each fifth day, and that all produce and manufactures had to be brought there, even from great distances, severe penalties being incurred by those who bartered the produce of land or labor on the highway or elsewhere. On the broad, straight, cemented roads leading to the locality of each market, 'resting-places' for the wayfarers and carriers were provided at regular intervals; and, by the number of such stopping-places between one point and another, distances were estimated.

The enormous concourse of people, the variety of produce exhibited, and the order that prevailed in the markets of Mexico and Tlatelolco, filled the conqueror with wonder and admiration. From Cortes, Bernal Diaz, Sahagun, and others, we learn that the market was a special charge of the supreme chief of Mexico; that appointed officers presided in state over it, while others moved among the throng superintending the traffic. Standard measures were kept, and rigorous punishment awaited those who sold by false measure or bartered stolen goods.

It is my opinion, and one that I can support by a mass of further corroborative evidence, that the periodical market-day was the most important regulator of the Mexican social organization, and that the monolith generally known as the calendar-stone was the market-stone of the City of Mexico. It bears the record of fixed market-days; and I venture to suggest that from these the formation of the Mexican calendar system originated. The stone shows the existence of communal property and of an equal division of general contributions into certain portions. I find, moreover, that the face enclosed in the inner circle of the tablet is a rebus. When its several parts are interpreted by the phonetic elements they represent, a sentence is obtained which clearly shows the use of the tablet. Of this sentence I shall submit but two

words, deeming these sufficient, for the present, to prove my method and its results.

Thus from the phonetic elements *tetl* ('stone'), *ixtli* ('face or surface'), *pan* ('upon'), is obtained, by combination, according to rules of the Nahuatl grammar, the word *teixpan*, meaning 'publicly.'

Now, turning to the monolith generally known as the sacrificial stone, I find it to be a law-stone of similar nature, recording the periodical collection of certain tributes paid by subjugated tribes and others whose obligation it was to contribute to the common wealth of Mexico. A symbolic

THE MEXICAN CALENDAR-STONE.

In Molina's dictionary the noun *teixpanca* is translated as 'something evident and manifest to all.' The protruding tongue yields the two elements of the word *nenepilquiça* ('to mark, note, keep account of'), formed by *nenepilli* ('tongue') and *quiça* ('to go out'). These statements are, of course, almost meaningless to any but Nahuatl students acquainted with the pictographic system.

frieze around the stone consists of groups, placed at intervals, of flints (*tecpatl*), with conventionally carved teeth (*tlantli*), giving, in combination, the word *tecpatlantli*. This word occurs in Sahagun's 'Historia' as the name given to the 'lands of the palace,' and in one of the native works I find designated the four channels into which the produce of these lands was diverted.

The periods indicated on it differ from those on the great market-stone, and seem to furnish a solution to the perplexing complementary calendar system mentioned by Spanish writers as 'the lords of the night accompanying the days.'

In conclusion, I would state, that, in my opinion, many of the large stone receptacles that are generally called 'vessels for containing the hearts and blood of human victims' are no other than the standard measures, preserved for reference in the market-place.

Before publishing my final results, I shall submit them to a searching and prolonged investigation. An examination of the originals of many of the codices reproduced in Lord Kingsborough's 'Mexican antiquities' will be necessary to determine important points, and during the forthcoming year my line of researches will be in this direction. ZELIA NUTTALL.

HOW TO MAKE THE MOST OF A SMALL LIBRARY. [1]

THE question is not what to do with a library of five hundred thousand, or a hundred thousand, or fifty thousand volumes. It has nothing to do with libraries which can afford to buy manuscripts or incunabula, black-letter tracts, or early American sermons. It is not for libraries whose collections of original authorities took away, many years ago, the cause of John Adams's reproach that in his time the books from which Gibbon's statements might be proved true or false could not be found in the United States. A student may go to the libraries in the great cities and read at his will, order from abroad books relating to his specialty, or, if he can show just cause for his request, may even have books sent to his distant home. The libraries which concern us are those of thirty, or ten, or five, or even of one thousand volumes, in towns and villages, open, perhaps, all day six days in the week, or two or three hours on one day. I mean this for you, whose library spends a thousand dollars a year; and you, who have but five hundred for books, periodicals, and binding; and you, who struggle along with fifty dollars' worth of new books twice a year. It is for you, too, whose library has existed in a half-alive state with poor American reprints of English books, novels in wretched condition, antiquated volumes of science, biographies of the dreariest, incomplete volumes of magazines. How can such libraries be made centres of sweetness and light in country towns?

'Your house is not large enough to swing a cat in,' said a man to his friend. 'But I don't wish to swing a cat,' answered the friend. This bit of homely wisdom, and another, 'When you can't have what you like, you must like what you have,' are as useful in libraries as anywhere else.

But they do not mean that you are to be satisfied with the present use of many of the books which are now gathering dust upon your shelves. Some of them may easily be made to answer the questions of your readers. Spend the next money that you have in a few books of reference, a new edition of an encyclopaedia, a good atlas, 'Lippincott's biographical dictionary,' 'Poole's index,' and its co-operative supplement the Brooklyn catalogue, and the Providence reference-lists. If you can get also, or if you have already, all the volumes of *Harper's magazine*, *Scribner's monthly*, and the *Century*, the *Popular science monthly*, and *Littell's living age*, with the separate indexes, including articles and poems too short to be indexed in Poole, you are ready to meet the wants of most of your readers. If you have time, index *St. Nicholas*, *Wide awake*, and *Harper's young people*. A librarian of a small library can often satisfy a reader by showing him an article written ostensibly for children, but told in the clear, simple style which appeals to many older persons. The thinking powers of many boys and girls never develop after they leave school at fifteen; and knowledge, in order to be attractive to them in their later years, must be set forth as attractively as in their school-days. If you can overcome the repugnance of many persons to books which they think childish and beneath them, you can often give them just what they are able to enjoy. I sometimes say, "The best article that I know is in the *Wide awake* [or *St. Nicholas*, or *Harper's young people*], and, if you have no objection to reading a boys' and girls' magazine, I think that you will find in it just what you need."

A magazine which has a department of 'Answers to correspondents' asked, in a late number, for no questions which might be answered by referring to an encyclopaedia or biographical dictionary. In the next number a correspondent begged the editor to remember that many persons had no access to such books, and their only way of learning what they wished to know was through the magazine. The library in every town or village should supply this want, and should also contain Brewer's 'Reader's hand-book' and 'Dictionary of phrase and fable' (which, though often inaccurate, are much better than nothing), and Wheeler's 'Dictionary of noted names of fiction,' and 'Familiar allusions.' As soon as you can afford it, buy all the volumes of 'Notes and queries;' but until then you can answer many questions from the books of reference already named.

[1] Read before the Milwaukee meeting of the Library association by Miss C. M. Hewins, July 7, 1886.

The stock questions with which every librarian is familiar, such as who wrote 'I am dying, Egypt, dying,' whether Shakspeare was of noble birth, or Eleazar Williams was Louis XVII., are easily disposed of. If you can make your readers understand that they must formulate their requests in intelligible shape, you have gone a long way towards making your library useful. They expect a librarian to find 'a book about cheerfulness;' or 'a book about whether education is better than wealth;' or 'a book in marbled covers that wasn't exactly a history, but had something about history in it, that mother read about nine years ago.'

This is no place for discussing the merits of rival encyclopaedias. I find the Britannica, Chambers's, Appletons', and Johnson's all useful. If I could have only one, and no atlas, I should take Appletons', on account of its maps, its full lives of living persons, and its yearly supplement. A person often goes to a library with a question which he fancies can be answered only by reference to many learned books, but really is a very simple one. A stranger from out of town once said to me with a pompous air, "I am pursuing an extensive course of historical reading, and wish to know what works the library contains on the history of Constantinople." I meekly replied that we had only a very few of the original authorities, and that they were in English translations. "What have you, then?" I named the more familiar histories, and a few recent books of travel, like De Amicis' and Gautier's. "I wish to see a minute map of the city." — "We have nothing minute. The best that I can give you is in the 'Encyclopaedia Britannica.'" — "Ah, indeed! That is a work I have never heard of. May I see it?" This confession betrayed at once the depth of the stranger's learning. He read the encyclopaedia for about ten minutes, then returned it with thanks, and went away saying that he had now finished his course of reading on Constantinople. An encyclopaedia often satisfies the vague desire for knowledge, of a person who has not learned how to use books, and asks in an indefinite way for something on a certain subject.

The Brooklyn catalogue is especially useful in its biographical references to lives in books which, without it, might stand unopened on the shelves. For example: a librarian, when asked for a life of Queen Christina of Sweden, might not remember, without consulting it, that, although there was no life of her in the library, chapters upon her might be found in Wilkie Collins's 'Miscellanies,' Hays's 'Female biography,' Mrs. Jameson's 'Lives of female sovereigns,' and Russell's 'Extraordinary women.' 'Poole's index' unlocks *Littell's living age*, which is full of biographical and historical articles. Every volume of essays in a library should be indexed, and every title placed in the catalogue.

The question of what kind of catalogue you should have is one that depends largely on the number of your readers and the kind of books which they take. A printed one soon grows obsolete. A card-catalogue, well arranged under authors and subjects, with zinc indicators to show the places of subjects, and brass rods so that the cards cannot be displaced, is as good as any thing that has yet been used. "I made my catalogue," said a librarian to me a year or two ago, "so that the greatest fool in town could not possibly make a mistake in finding an author or title." This catalogue is certainly a model of clearness and simplicity. Long experience with fixed shelf-numbers has convinced me that they should not be used, but should give place to the Dewey plan or one of its modifications.

The books which you buy should depend, like your catalogue, on your class of readers. A library in a village where there are farms and gardens should have the latest and best books upon farming, gardening, the care of cattle and poultry, and several agricultural and horticultural papers and magazines, that may be allowed to circulate after they are bound. I saw not long ago, in a newly endowed library in such a town, several books with finely colored illustrations of beautiful-leaved plants and flowering shrubs, that must certainly have an influence in time in making the gardens of the neighborhood very different from the traditional farmhouse door-yard. A town with telephones, electric lights, machine-shops, and manufactories, where many young men of intelligence are electrical engineers, machinists, and draughtsmen, needs all the newest books that it can afford to buy, on electricity, applied mechanics, and mechanical drawing. We find in Hartford a steadily increasing demand for books of these classes. Scientific works, unless of recent date, are worse than useless, except to a student of the history of science. A person who asks for a book on physics or chemistry from a printed catalogue does not always notice the imprint, and chooses a work quite out of date. A librarian can and should tell him where to find a newer and better one.

The use of books on special subjects grows every year. The Society for study at home, the Chautauqua society, many smaller clubs, *Queries* and other periodicals, with their lists of prize questions, have all done their part in encouraging readers to use libraries. The prize questions are often such as anybody might write by opening any volume of history or biography at random and

framing a question about the first name or subject on the page. Such questions are a severe tax on a librarian's time and patience; but, if a reader comes in search of answers, he must be kindly received, and all the resources of the library placed at his disposal. A librarian needs a certain tact and skill in guessing at the wants of readers. This comes by practice, after one has learned to estimate the mind-power of the frequenters of a library. 'Can you give me something on the French revolution?' asks a young girl. Instead of offering Thiers, or Carlyle, or even the 'Epoch of history' volume, the librarian asks, 'How long an account do you wish, — one in several volumes?' — 'Oh, not very long, and not very deep, please.' — 'An historical novel, perhaps?' — 'Yes,' with a visible brightening of the face; and the reader goes home happy with 'Citoyenne Jacqueline,' perhaps to come back and ask for another novel of the same period, or even a history. It is, however, too much to expect that every reader who desires a little historical knowledge will go through a course of many-volumed books. The various lists of historical novels published by the Boston public library and other libraries, Professor Allen's 'Catalogue of novels and poems on English history,' and Adams's 'Manual of historical literature,' are every-day helps in even the smallest library. It is not hard for a librarian to make a list of the novels in his or her own library which illustrate different periods. A small library has this advantage over a large one, that it cannot afford to buy poor novels. Miss Hewins closed with a list of about seven hundred dollars' worth of books made for the beginning of a free library in a manufacturing and farming town, whose inhabitants are of average intelligence.

THE AGE OF ELECTRICITY.

In the closing sentence of this book the author remarks that we are to-day entering upon the age of electricity; so that, in spite of its title, the volume must be regarded as a discussion of incidents in the world's history which were necessary and preliminary to its complete preparation for the phase of its existence which it is now about to take on. Now and then, throughout its nearly four hundred pages, prophetic glimpses are afforded of what this age may have in store for us, but in the main the author has confined himself to the safer ground of already accomplished fact.

The reader is carried from the 'myth of the amber-soul,' which is discoursed upon in the first chapter, to nearly the latest application filed in the patent office up to date; and, in a general way, the task of summarizing the vast amount of information which scattered itself with great irregularity along the centuries from the earliest of these dates to the latest has been well and satisfactorily performed.

The book is written in the interests of the general public, and is nearly free from technicalities, which are so often a bugbear to the general reader. While not especially intended for the student of electricity, it will prove to be a useful book of reference to many whose collections are limited, as it contains a good deal of historical information not otherwise accessible in a single volume. Considered in relation to the supposed demands of the general reader, the author has perhaps erred somewhat in often going into details which may serve to complicate rather than to simplify, and, in a few instances, in avoiding the discussion of an interesting subject because of its seeming difficulty.

Several inaccurate and misleading statements are found scattered through the book, which are all the more noticeable on account of its general excellence. Early in his discussion the author defines the units now commonly used in electrical measurement: but he has not been able to avoid confusion in their use subsequently, as when he states that the quantity of current necessary to decompose a grain of water is 3.13 ampères, and in other instances. Many readers will be astonished at the statement that the resistance of a battery-cell is in no way altered by increasing or diminishing the size of the plates. The assumption of the resistance of what the author continually calls a 'strange atmosphere' around the poles of a magnet, and in the neighborhood of a conductor conveying a current, in order to account for the phenomena of the magnetic field, would hardly seem to be warranted, even in a popular treatment of the subject.

In his historical references, the author is disposed to give due credit to American science and invention, although in his discussion of the induction coil he nowhere mentions the important contributions of Mr. E. L. Ritchie; and his treatment of contemporaneous discovery and invention does not seem to be quite free from prejudice and bias.

Notwithstanding these and some other faults, the book contains a vast amount of interesting information, presented in an interesting way, and it will doubtless find an appreciative audience. It presents a handsome appearance, and the numerous illustrations are generally appropriate adjuncts to the text. In the fine full-page cut, however, showing a man of war destroyed by a fish-torpedo,

The age of electricity. By Park Benjamin. New York, *Scribner*, 1886. 12°.

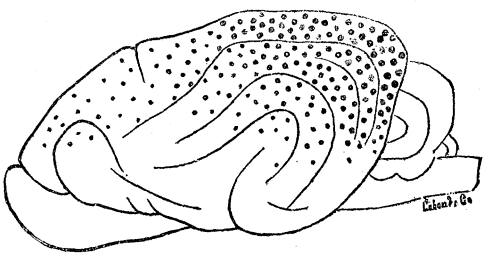
it is a little curious to see, that, while the great ship is certainly going to the bottom, the small torpedo-boat itself floats apparently uninjured.

LOCALIZATION OF FUNCTION IN THE CORTEX OF THE BRAIN.

A CONVENIENT summary of the main points that have been established by experiments on animals, by pathological records and anatomical research, regarding the relation of certain parts of the brain to the various senses and systems of muscles, is a very welcome contribution to this vexed question. If, in addition, the work brings new light on some of the problems, and a worthy appreciation of its predecessors, it is doubly welcome. The recent work of Dr. Luciani and Dr. Seppilli has these claims to our highest praise.

The view of Flourens, that all the parts of the brain were functionally equivalent, was followed, after the discovery of the excitability of the cortex in 1870, by the very opposite view that the brain consisted of a collection of areas definitely circumscribed, each of which had exclusive charge of a certain function. The view held by our authors, agreeing with that of Exner, Goltz, and others, is a mean between the two. The different parts of the cortex have very different relations to the several functions. But a centre is not a definitely limited area: it has a focus and a 'periphery,' but no hard and fast boundary-lines. The peripheries of the various centres overlap. Take the usual centre, for example. If you regard the sight-centre as all that part of the cortex the removal of which will cause disturbances of vision, then this centre is almost too extended to be localized at all; but, if you distinguish between transitory and permanent (though gradually decreasing) impairment of vision, the occipital lobe, with a small part of the adjoining parietal, is at once marked as the focus of the sight-centre: its 'periphery' extends in the direction of the frontal and temporal lobes. An injury to the peripheral portions will cause less severe and less permanent impairment of vision than injury to the focus.

The extensive destruction of one occipital lobe produces blindness in a small external segment of the retina on the same side, and in a large internal segment of the retina on the opposite side; i.e., each centre is connected with both sides of the body, but more with the opposite side. This furnishes a simple scheme of the decussation of fibres in the optic chiasma. The general results are compactly represented in a diagram of the dog's brain, in which the size and proximity of the dots show the 'intensity' of the different parts of the centre, while the shaded dots show the proportion of the centre connected with the same side of the body.



The accompanying diagram of the dog's brain shows the location and extent of the *visual centres*, as proved by the impairment of vision due to extirpation of this area. The occipital region, as indicated by the size and frequency of the dots, is most immediately connected with this function; but an area of minor intensity extends towards the frontal and parietal lobes. The shaded dots indicate (roughly) the part (a smaller one) of the centre connected with the retina of the same side; the others, the part (a larger one) connected with the opposite retina.

The centre for hearing has likewise a focus and a periphery, and the scheme of decussation would be quite the same. The focus is in the temporal lobe, with the periphery extending in the direction of the parietal and frontal lobes, of the hippocampus and cornu ammonis. The attempts at localizing the centres for smell and taste are less definite and less certain.

On the pathological side, the correlation of certain disorders with lesions of certain parts of the brain tends to the same results in the main, and thus makes the experimental evidence doubly important.

The central convolutions and the immediately adjoining parts of the parietal and frontal convolutions form the sensor-motor zone. It is the terminal station for the reception of skin and muscle impressions, as well as the origin of the voluntary control over certain muscles. The motor zone is directly excitable by electrical stimulation, and is the part the irritation of which produces epileptic spasms. A study of the order in which these spasms affect different groups of muscles, with a post-mortem examination of the brain, tends to a more definite localization of the facial centre, the arm-centre, and the leg-centre. The chapter on epilepsy, from the point of view of Hughlings-Jackson, is a valuable presentation of the subject.

Die functions-localisation auf der grosshirnrinde an thierexperimenten und klinischen fällen nachgewiesen. Von Dr. LUIGI LUCIANI und Dr. GIUSEPPE SEPPILLI. Autorisirte deutsche ausgabe von Dr. M. O. FRAENKEL. Lepzig, *Denicke*, 1886. 8°.

These cortical centres are not the places where the crude sensations are received, but the places where they are elaborated, interpreted, and associated with other impressions. They are perceptive centres.

The work of Luciani and Seppilli is an onward step in this difficult subject, and can be recommended as the best book to use for those who have only time for one book. While it leaves many problems unsolved, it gives hopes of a solution, and leaves the conviction that we are on the path towards a scientific and rational conception of the functions of the highest product of evolution, — the human cortex. JOSEPH JASTROW.

THE SEPARATE SYSTEM OF SEWERAGE.

THE respective merits of the separate and the combined systems of sewerage are still topics of animated discussion among sanitary engineers. Experts are not at one upon the question whether there should be one set of sewers through which should be removed the discharges from human beings and the water which in the form of rain falls upon the surface of the ground, or whether two separate and distinct sets should be constructed, each of which should be restricted to the removal of one of these varieties of waste material. The writers of this little book of 183 pages are advocates of the separate system, and believe that its moderate cost makes it possible to carry out a system of sewerage in many cases where the expense of the combined system would make the construction impossible. Most of the literature upon this subject is to be found in pamphlets, and papers presented to scientific societies, which are not available for general reference; and the authors have endeavored to supply a deficiency which their own experience has shown to exist by preparing the work now before us. Their aim has been to explain what the separate system is, what it is designed to do, and to give practical directions for designing and constructing sewers in accordance with that system. They recognize the fact that no single design is applicable to every case, but that each town will present some features peculiar to itself, and that the general plan must be modified to suit the conditions of each case. The dangers connected with, and indeed inseparable from, the old-style yard vaults and cesspools, in which filth accumulates oftentimes for years, are graphically portrayed; and the ordinary methods by which wells and streams become polluted are plainly and concisely explained. These are made a text for a homily upon the need of sewerage in all densely populated neighborhoods. The evils of the combined and the advantages of the separate system are contrasted; and the authors then pass on to the consideration of the designing of plans for the construction of a sewerage system, commencing with the preliminary survey, and carrying them up to the condition of completion, with the house-connections made, and the sewage on its way to the sea or other point of discharge. The volume is, considering its small size, a very comprehensive one, and will undoubtedly be of great service to those engaged in practical work of this kind.

The separate system of sewerage: its theory and construction. By CADY STALEY and GEORGE S. PIERSON. New York, *Van Nostrand*, 1886.

CHALLENGER REPORTS.

THIS bulky volume contains the second report of Professor Herdman on the Tunicata, comprising four hundred and thirty-two pages and fifty plates, and Théel's second part of the report on the Holothurioidea, with two hundred and ninety pages and sixteen plates. The high standard of mechanical execution which has characterized previous volumes is fully maintained in both text and plates.

Professor Herdman's first report treated of the simple ascidians. The present one is devoted to the compound forms; and a final part, to discuss the pelagic groups, will probably appear next year. It was at first supposed that the forms remaining after the simple ascidians had been described could be disposed of with comparative brevity; but the compound ascidians proved, on careful examination, to be a much larger and more varied group than had been anticipated. On account of the difficulty in finding good diagnostic characters, and of the similarity which different species sometimes show in their external appearance, it has been necessary to submit nearly all the species in the collection to a detailed histological examination, and portions of most of them have had to be sectionized — a slow and laborious proceeding — before the relations of their different parts could be satisfactorily determined. Then, in the case of a few species, some interesting peculiarities in regard to reproduction by gemmation required a careful and lengthened examination, on account of the important bearing of these features upon the mode of formation of the colony.

The collection of compound ascidians represents one hundred and two species and varieties, arranged in twenty-five genera. Eighty-eight of the species and ten of the genera are here de-

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scribed for the first time. A few simple ascidians, overlooked previously, find a place in an appendix.

Compound ascidians were figured by Rondeletius as early as 1555, but nothing of their structure was put on record until two hundred years later. Even then their relation to the simple ascidians was not suspected, though some of the main points in the anatomy of the latter were known to Aristotle.

Gaertner in 1774, and Renier in 1793, recognized the relations of one or two genera, but the majority of naturalists still confused the compound ascidians with Alcyonaria or with sponges. It was reserved for Cuvier and Savigny to demonstrate beyond all question the close affinity between the two groups of the Tunicata. This was in 1816; and, led by these investigations, Lamarck, about the same time, instituted the class Tunicata. Since then important researches on the compound forms have been made by Milne-Edwards, Gegenbauer, Krohn and Metchnikoff, Ganin, Giard, and von Drasche, as well as other students; while Professor Herdman, in the present paper, has summarized the existing knowledge, and added many remarkable anatomical discoveries of importance for the history of the group, to say nothing of the multitude of details useful to the special student, and evincing a thorough and patient method of study which enforces confidence in and gratitude for his prolonged investigations.

Dr. Théel, in the second part of his work on the holothurians, has not limited his labors to a description of the Apoda and Pedata which were brought home by the Challenger, but has added a short exposition of all the shallow-water forms hitherto known. It was rightly considered that such a monograph was highly desirable, though the difficulty of its preparation was very great, and various gaps necessarily occur in it on account of the frequent imperfections of the descriptions given by some authors. Material from many sources was put at the writer's disposal, especially the very rich collection of the Royal zoölogical museum at Stockholm.

The examination of the vast harvest of the Challenger voyage indicates a double derivation for the deep-sea holothurians. The Elasipoda, though species are found occasionally in shallow water in the arctic regions, cannot be derived from the same source as the usual shallow-water types. On the other hand, a certain proportion of the deep-sea species, such as forms of the Cucumariae, show intimate relations with the littoral fauna. The relations of the littoral to the abyssal fauna are discussed in an admirable manner by Dr. Théel, who regards the primitive holothurian to have been shaped like Cucumaria, with an open stone canal, feet, and a well-developed ambulacral system. Some forms have a great range in depth, the same species varying over seven hundred fathoms. Shallow-water genera sometimes reach a depth of some twenty-nine hundred fathoms, while the species are usually different from those of more moderate depths. The characteristic deep-sea forms, however, are the curious Elasipoda, which, as above mentioned, rarely are found except in the abysses.

Not a single species is common to the Arctic and Antarctic seas, though the shallow-water fauna presents much the same characteristics, and many of the species are very closely allied. Many species are circumpolar, but only a few circumequatorial. About 45 forms are known from the Arctic, 32 from the Antarctic, 135 from the Atlantic and Mediterranean, but no less than 305 from the Indo-Pacific region, which, it would certainly seem, must be the metropolis of these forms of animals.

The great value of Dr. Théel's work is self-evident, and only the limits of our space prevent a more thorough analysis. As it is, we have given but a few indications of the wealth it contains, for which the reader must be referred to the original.

ACCORDING to the latest returns published by the minister of agriculture, it appears, says the *Journal of the Society of arts*, that the chestnut-tree is cultivated in every province of Italy, excepting those of Milan, Cremona, Mantua, Rovigo, Ferrara, Ancona, Bari, Lecce, Syracuse, Girgenti, and Trapani, that is to say, it is cultivated in 56 provinces; and that, out of the 8,257 communes in Italy, it is cultivated in 1,313. The chestnut is cultivated on the most extensive scale in Liguria, and on the least in Sardinia. The total production throughout the kingdom, of fresh chestnuts, is 391,393 tons annually, which would average 1.33 kilograms per inhabitant; in Liguria it reaches 101.5 per head, and in Sicily only 3.57. A considerable quantity of chestnuts is exported to France, Austria, Egypt, Switzerland, and South America; while, on the other hand, a very insignificant quantity is imported from France, Austria, and Switzerland.

—A Parisian electrician has devised a mode of utilizing the residual liquids from bichromate and other powerful batteries. He mixes a porous acid-proof substance with the residual liquids, dries the paste thus produced, and uses it as a charge for batteries for telegraphic purposes.